No. 3, 000, 000

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Whereas Kenneth R. Eldredge, of Palo Alto, California, assignor, by mesne assignment, to General Electric Company, of New York, N. Y., a corporation of New York,

PRESENTED TO THE **Commissioner of Patents** A PETITION PRAYING FOR THE GRANT OF LETTERS PATENT FOR AN ALLEGED NEW AND USEFUL INVENTION THE TITLE AND A DESCRIPTION OF WHICH ARE CONTAINED IN THE SPECIFICATION OF WHICH A COPY IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND COMPLIED WITH THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED, AND

Whereas UPON DUE EXAMINATION MADE THE SAID CLAIMANT is ADJUDGED TO BE JUSTLY ENTITLED TO A PATENT UNDER THE LAW.

NOW THEREFORE THESE **Letters Patent** ARE TO GRANT UNTO THE SAID

General Electric Company, its successors OR ASSIGNS

FOR THE TERM OF SEVENTEEN YEARS FROM THE DATE OF THIS GRANT

RIGHT TO EXCLUDE OTHERS FROM MAKING, USING OR SELLING THE SAID INVEN-
THROUGHOUT THE UNITED STATES.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington this twelfth *day of* September, *in the year of our Lord one thousand nine hundred and* sixty-one, *and of the Independence of the United States of America the one hundred and* eighty-sixth.

Attest:

Ernest W. Swider
Attesting Officer.

David L. Ladd
Commissioner of Patents.

3000000TH PATENT

THE DEVELOPMENT OF A SYMBOL READER

Dr. Kenneth R. Eldredge, a staff scientist for Stanford Research Institute, Menlo Park, California, invented the Automatic Reading System of Patent No. 3, 000, 000, granted September 12, 1961. Dr. Eldredge's system is the foundation for check processing systems using Magnetic Ink Character Recognition techniques (MICR) now used by major banks across the country.

The symbol reading research and development program carried on by Dr. Eldredge and his associates at Stanford Research Institute was originally sponsored by Bank of America. In fact, the original Eldredge symbol reader was first put in commercial use by Bank of America in 1955, for processing of the Bank's Travelers Checks.

General Electric Company's Computer Department, Phoenix, Arizona, assumed sponsorship of the development program early in 1956, when the Company was awarded a contract by Bank of America for development of the ERMA system. At that time the Eldredge patent was assigned to General Electric's Computer Department.

The ERMA contract called for development and manufacture of a large number of complete data-processing systems for performing the Bank's check accounting for more than two million accounts in its more than 700 branches throughout California.

To accomplish this tremendous task, a reliable and accurate symbol reader had to be developed. This should be capable of reading the same symbols which make up our human language. The reader should also be capable of reading documents which had been handled by the public and had become defaced by writing, stamping and overprinting or which had become wrinkled or bent in handling.

With these criteria in the background, Dr. Eldredge invented his Automatic Reading System of Patent No. 3, 000, 000. His invention is an electronic device for reading at extremely high speeds, bank checks and other documents such as deposit slips, utility bills, etc. These documents contain such information as dollar amount, customer account number,

Dr. Kenneth R. Eldredge, staff scientist at Stanford Research Institute with the Automatic Reading System, for which Patent No. 3, 000, 000 was granted by the United States Patent Office on September 12, 1961.

transaction code for determining debit or credit entry, and bank identification code. The information is printed in human language symbols so that clerks can, without special training, read the same information that the electronic symbol reader recognizes. The information read from these documents is converted to machine language and is delivered to a computer for automatically performing the bank check-accounting functions and also to a sorting machine for automatically sorting the checks and other documents.

Ink used in printing bank checks contains millions of tiny magnetic particles. Human operators read the same information on the check that the invention reads. The Automatic Reading System reads the information by responding to the magnetic pattern derived from the symbol configuration of the magnetic particles.

The symbol reader consists of four main parts: a magnetizer, a magnetic eye, a memory and a recognizer. The magnetizer and magnetic eye are mounted on the sorting machine which carries the documents at extremely high speed past the magnetizer to magnetize the magnetic particles and then past the magnetic eye which senses the magnetic pattern of each symbol.

The magnetic eye delivers a signal to the recognizer in much the same manner as the human eye senses the visual pattern of the symbol and delivers a signal to the brain. The memory of the electronic reader stores an image of each different symbol which the reader is designed to identify. The recognizer compares the signal provided by the magnetic eye with each image stored in the memory.

When the signal matches one of the stored images, the symbol reader "informs" the computer or the sorter, or both, of the identity of the symbol read. During this process the electronic reader converts the human language to machine language for use in the accounting and sorting machine operations.

P. E. Merritt and C. M. Steele, Dr. Eldredge's co-workers at SRI, anticipated the need for a recognition system which, coupled with Dr. Edlredge's invention, would recognize poorly printed characters. Therefore, Merritt and Steele invented an improvement, for use with Eldredge's invention, which consisted of a symbol recognition system known as wave-form correlation. This Merritt and Steele invention has since been issued as U. S. patent 2, 924, 812. Merritt and Steele, therefore, opened the way for wide-spread adoption of magnetic character reading by providing a system which, in conjunction with Dr. Eldredge's invention, would reliably read characters printed by any printing machine, even including typewriters and listing machines in accordance with ordinary commercial printing quality.

When these inventions proved to be commercially feasible, General Electric undertook the development of a production model symbol reader, following the principles of Dr. Eldredge, Mr. Merritt and Mr Steele.

Mr. R. E. Milford of General Electric's General Engineering Laboratory in Schenectady, New York, now located at the Computer Department in Phoenix, Arizona, completely re-designed the earlier symbol reader, using transistors rather than vacuum tubes. During this re-design, he made several inventions in transistor circuitry for providing further increased reliability and for detecting reading errors caused by worn, torn and otherwise defective symbols.

Mr. Milford also originated the E-13B type font which has been adopted by the American Banking Association for use by member banks throughout the country and which has been adopted elsewhere in the world as the common language for automatic bank check accounting.

Mr. George Miller of the General Electric Computer Laboratory in Mountain View, California, further refined Mr. Milford's design by providing safety features for preventing reading errors caused by foreign iron and other magnetic particles in the document paper and in the printing of the symbols themselves.

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